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Freismuth et al.

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[54] **ALTITUDE AND TEMPERATURE COMPENSATED CARBURETOR**

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[73] Assignee: **Ford Motor Company,** Dearborn, Mich.

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[52] **U.S. Cl.** ..... **261/23 A,** 261/39 A, 261/63, 261/DIG. 56

[51] **Int. Cl.** **F02m 7/20**

[58] **Field of Search** ... 261/39 A, 63, 39 B, DIG. 56, 261/23 A

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[57] **ABSTRACT**

A carburetor for an internal combustion engine having means to regulate the air flow in response to ambient air temperature and pressure. The carburetor includes a member protrudable into the main venturi portion to reduce progressively the effective area thereof as temperatures or altitudes decrease, and conversely. The carburetor includes a bypass passage having valve means that permits the addition of supplementary air to the idle system at high temperatures or altitudes and reduces progressively the quantity of added air as the altitude or temperature decreases.

7 Claims, 3 Drawing Figures

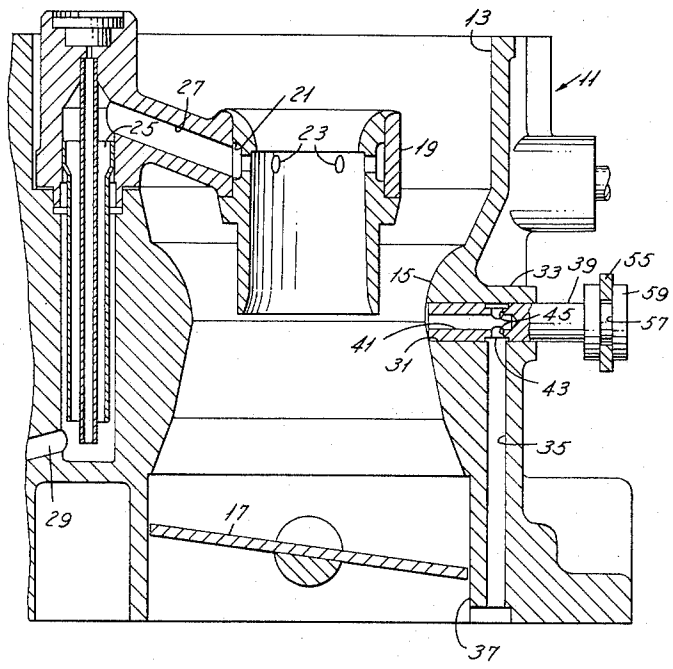


FIG. 1

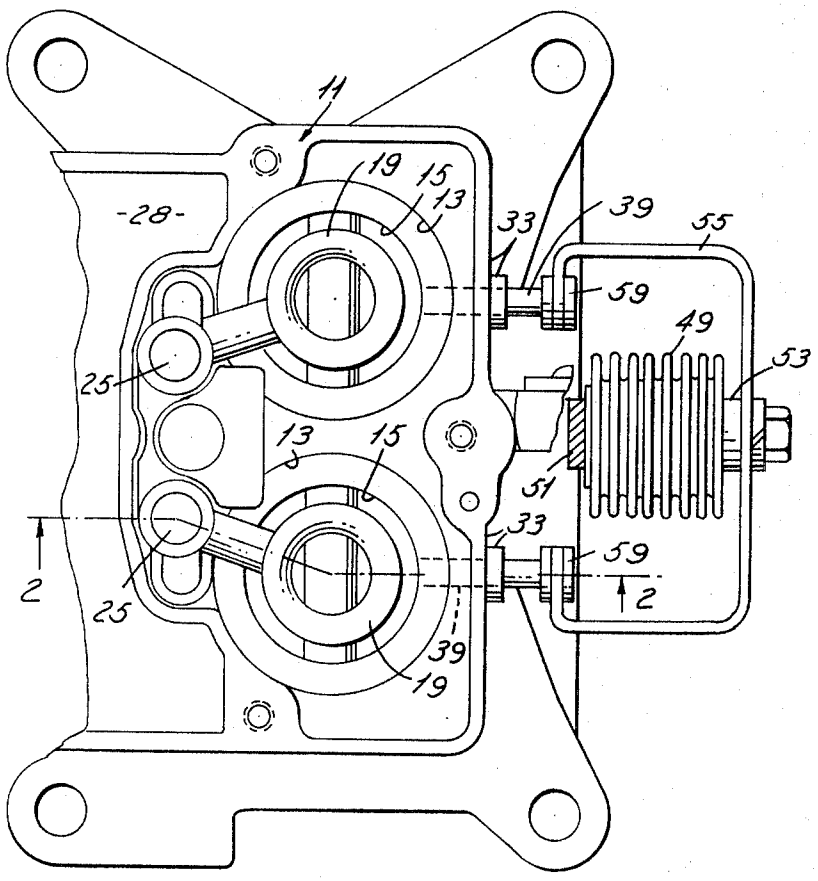


FIG. 2

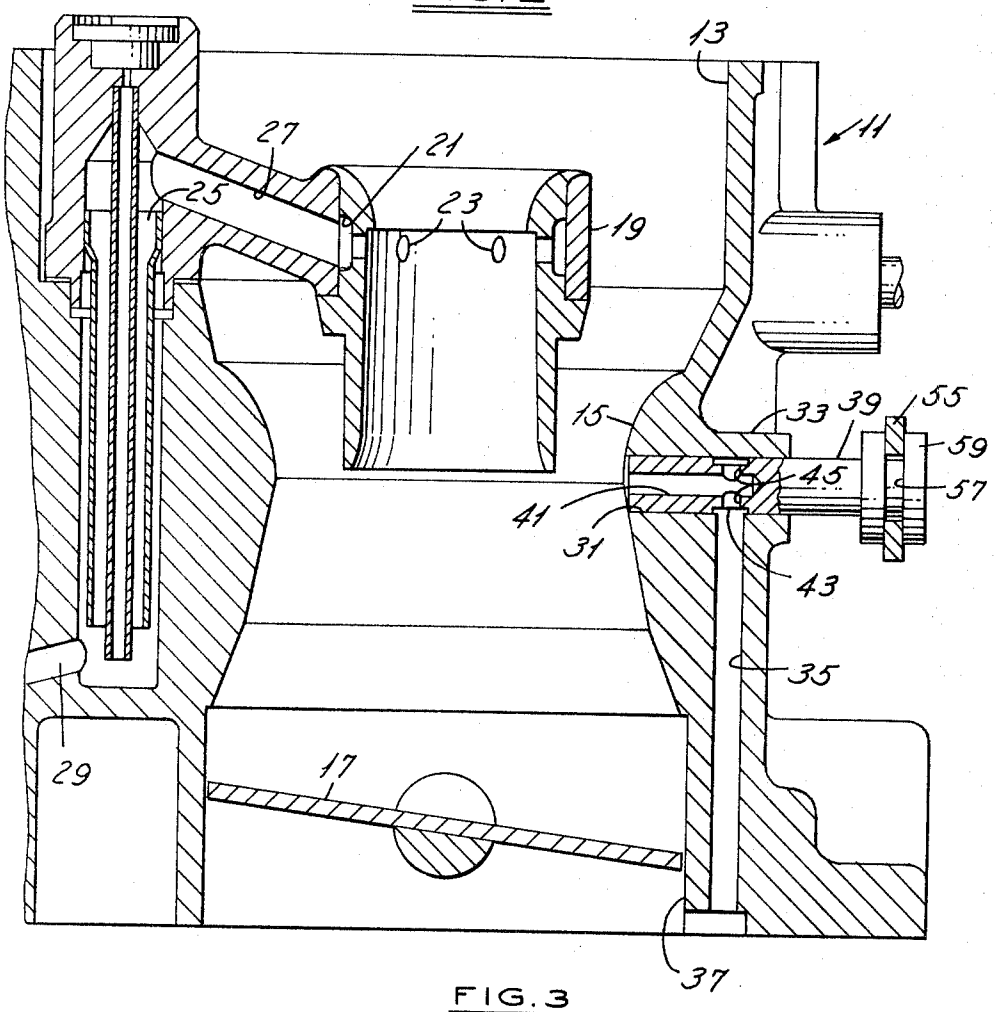
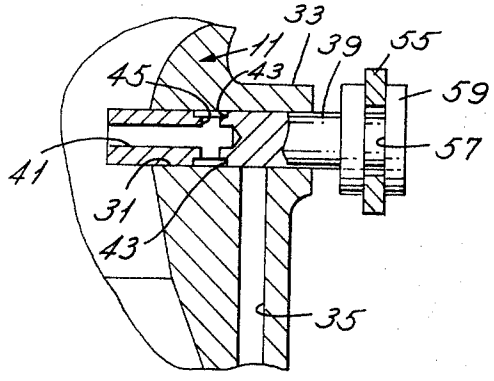

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FIG. 3


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ALTITUDE AND TEMPERATURE COMPENSATED CARBURETOR

BACKGROUND AND SUMMARY OF THE INVENTION

The fuel flow through the main fuel metering system or to the venturi system of a typical carburetor is proportional to the air velocity through the venturi system. Even though the velocity or volume flow rate of air through the venturi system remains constant, the mass flow rate varies as a function of temperature and air pressure. One method of maintaining a relatively stable fuel/air ratio is to meter the fuel in proportion to the air density, a function of air temperature and pressure. Such a method requires precise and sensitive fuel control apparatus which may be costly to produce and expensive to maintain.

It is an object of this invention to provide a carburetor capable of maintaining a constant fuel/air ratio while experiencing variations in ambient air temperature and pressure. It is another object to provide a carburetor which accommodates for changes in air density by varying the air flow through the carburetor. It is a further object of this invention to provide a system which adjusts the idle mixture of the carburetor in response to the ambient air temperature and pressure without requiring precise regulation of idle fuel flow. It is another object of this invention to provide altitude and temperature compensating apparatus for a carburetor which is economical to produce, simple to maintain, and which may utilize conventional carburetor design without extensive redesign of basic carburetor structure.

An internal combustion engine carburetor having altitude and temperature compensating means constructed in accordance with this invention includes a carburetor body having an induction passage to receive air and discharge a combustible fuel and air mixture. A restriction element is movable relative to the body within the induction passage to vary the effective area thereof. Means responsive to air and temperature pressure is connected to the restriction corresponding to the ambient air temperature and pressure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view of a two-barrel carburetor main body portion constructed in accordance with the invention.

FIG. 2 is an axial, cross-sectional view taken along line 2—2 of FIG. 1, showing the relationship of elements under high altitude or high temperature conditions.

FIG. 3 is a portion of an axial, cross-sectional view similar to FIG. 1 showing the relationship of elements under low altitude or low temperature conditions.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A main body portion 11 of a two-barrel carburetor includes a pair of barrels or induction passages 13. Formed in each induction passage is a main venturi 15. Downstream of the main venturi is a pivotally mounted throttle plate 17. A booster venturi 19 is positioned concentrically within the induction passage so that its downstream end is adjacent the minimum cross-sectional area portion of the main venturi. The booster venturi includes an annular passage 21 and a plurality of fuel outlets 23 interconnected with a main fuel well 25 by passage 27. The main fuel well is, in turn, connected with the carburetor float bowl 28 by passage 29.

A bore 31 is formed in the wall 33 of the carburetor 11 substantially perpendicular to the axis of the induction passage 13 and opens into the main venturi portion 15 at its minimum cross-sectional area. A conduit or passage 35 connects an intermediate portion of the bore 31 with the portion 37 of the induction passage 13 downstream of the throttle plate 17 when closed. Slidingly and sealingly received within the bore 31 is an elongate cylindrical plunger or restriction element 39. A second bore 41 extends longitudinally from the inner end of the plunger element 39 and terminates at a point intermediate the two ends of the element. An annular recess 43 is formed about the plunger element at an intermediate portion thereof and is connected to the second bore 41 by passages 45. The annular recess 43 is located on the elongate element in such a position that it is immediately over the upper end of passage 35 when the inner end of the plunger element 39 is at maximum retraction and substantially flush with the surface of venturi 15 as shown in FIG. 2.

An aneroid bellows 49 is positioned between the plunger elements 39 and is secured at one end to a portion 51 of the carburetor body 11. Attached to the other end 53 of the aneroid bellows is a connecting bracket 55 that engages slots 57 in heads 59 of the plunger elements 39 causing the end 53 of the aneroid bellows and the plunger elements 39 to move as a unit in response to changes in air temperature and pressure.

OPERATION

Air passing through the main and booster venturis of a conventional carburetor at a given velocity creates a reduced pressure within the venturis so that fuel is delivered from the fuel bowl (at atmospheric pressure) to the venturis at a rate proportional to the air velocity. At low altitudes or at low temperatures the air density is greater than it is at higher altitudes and temperatures. Consequently, the fuel/air ratio of a given venturi experiencing a given velocity of air will increase or enrichen as the altitude or temperature increases. To maintain a constant fuel/air ratio as temperature or altitude increases either fuel flow must be lessened or air flow must be increased.

This invention accommodates for the change in air density by increasing the effective throat area of the main venturi 15 as altitude or air temperature increases. This is accomplished by the movement at plunger element 39 which protrudes into the main venturi at low temperatures or pressure as shown in FIG. 3 and retracts ultimately to the position shown in FIG. 2 as temperatures or pressures increase. The retraction is caused by the expansion of the aneroid bellows 49.

When the engine is idling and the throttle plate is closed, an idle system of a conventional carburetor draws fuel and air through restrictive orifices (not shown) directly into the portion of the induction passage beneath the throttle plate. The volume of fuel and air drawn is substantially independent of air temperature or pressure. Consequently, at higher altitudes or higher temperatures a given volume of air contains less mass than at lower temperatures or altitudes creating,

in the conventional idle system, a richer condition at higher altitudes or temperatures than at lower altitudes and temperatures.

This invention provides means to maintain a constant fuel/air ratio during engine idle comprising an auxiliary or supplementary air bleed system. This system includes passages **41** and **35.** At low altitudes or low temperatures the reduced length of the aneroid bellows **49** positions the annular recess **43** to the left of the upper opening of the passage **35** causing the normal diameter of the plunger element **39** to separate passage **35** from passage or bore **41,** as shown in FIG. **3.** As the altitude or temperature increases the aneroid element moves the plunger element **49** rightwardly causing the annular recess **43** to cooperate with the upper end of passage **35** until it progressively reaches the fully open position shown in FIG. **2.** In this position a maximum flow of supplementary air is permitted to maintain a desired fuel/air ratio.

It may thus be seen that the invention provides means to maintain consistent fuel/air ratios through the main fuel or venturi system and through the idle system at varying air temperatures and pressures. Modifications and alterations will occur to those skilled in the art that are included within the scope of the following claims.

We claim:

1. A carburetor for an internal combustion engine,
said carburetor including a body having an induction passage formed therein,
a restriction element movable relative to said body constructed to vary the area of said passage,
means responsive to ambient air temperature and pressure connected to said element to locate said element in a position of corresponding restriction,

said induction passage including a venturi portion,
said restriction element being immediately adjacent the minimum cross-sectional area of said venturi portion,
said restriction element comprising an elongate member having a cylindrical portion,
a bore formed in said body opening into said passage slidingly and sealingly receiving said cylindrical portion,
said restriction element being positionable to protrude from said bore into said venturi portion to reduce the effective area thereof,
said restriction element increasing its protrusion into said venturi portion in response to a decrease in the ambient air temperature or an increase in the ambient air pressure,
a booster venturi positioned within said induction passage substantially concentric with and adjacent to said first-mentioned venturi portion,
said elongate member being protrudable to reduce the effective area between an outer surface of the booster venturi and the inner surface of the first-mentioned venturi portion.

2. A carburetor according to claim **1,**
said bore being generally perpendicular to the axis of venturi portion.

3. A carburetor according to claim **1,**
said means responsive to ambient air temperatures and pressure comprising an aneroid bellows.

4. A carburetor according to claim **1,**
said carburetor including a throttle plate pivotally mounted within said induction passage,
a second passage connecting a portion of said induction passage downstream of said throttle plate,
valve means in said second passage constructed to regulate air flow in said second passage,
said valve means being progressively openable and closeable in response to said means responsive to ambient air temperature and pressure.

5. A carburetor according to claim **1,**
said carburetor including a throttle plate pivotally mounted within said induction passage,
a second passage connecting a portion at said induction passage upstream at said throttle plate to a portion of said induction passage downstream of said throttle plate,
a portion of said second passage being formed within said elongate member,
said elongate member including sliding valve means constructed to open and close said second passage in response to movement of said elongate member.

6. A carburetor according to claim **2,**
said carburetor including a throttle plate pivotally mounted within said induction passage downstream of said throttle plate,
a second passage connecting said venturi portion to a portion of said induction passage downstream of said throttle plate,
a longitudinally extending second bore formed in said elongate member opening on the protrudable end of said elongate member comprising a first portion of said second passage,
an annular recess formed in said elongate member connected with said second bore and positionable over a second portion of said second passage formed in said carburetor body for communication therewith, said annular recess being spaced from said second portion of said second passage when said elongate member is fully protruding, said annular recess being positioned over said second portion when the elongate member is fully retracted from said induction passage.

7. A carburetor for an internal combustion engine,
said carburetor including a body having an induction passage formed therein,
a restriction element movable relative to said body constructed to vary the area of said passage,
means responsive to ambient air temperature and pressure connected to said element to locate said element in a position of corresponding restriction,

said induction passage including a venturi portion,
said restriction element being immediately adjacent the minimum cross-sectional area of said venturi portion,
said restriction element comprising an elongate member having a cylindrical portion,
a bore formed in said body opening into said passage slidingly and sealingly receiving said cylindrical portion,
said restriction element being positionable to protrude from said bore into said venturi portion to reduce the effective area thereof,
said restriction element increasing its protrusion into said venturi portion in response to a decrease in the

ambient air temperature or an increase in the ambient air pressure,

said bore being generally perpendicular to the axis of venturi portion,

said carburetor including a throttle plate pivotally mounted within said induction passage downstream of said throttle plate,

a second passage connecting said venturi portion to a portion of said induction passage downstream of said throttle plate,

a longitudinally extending second bore formed in said elongate member opening on the protrudable end of said elongate member comprising a first portion of said second passage,

an annular recess formed in said elongate member connected with said second bore and positionable over a second portion of said second passage formed in said carburetor body for communication therewith, said annular recess being spaced from said second portion of said second passage when said elongate member is fully protruding, said annular recess being positioned over said second portion when the elongate member is fully retracted from said induction passage.

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